

# (12) UK Patent Application (19) GB (11) 2 311 932 (13) A

(43) Date of A Publication 15.10.1997

(21) Application No 9707056.9

(22) Date of Filing 07.04.1997

(30) Priority Data

(31) PN96A0022 (32) 10.04.1996 (33) IT

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(51) INT CL<sup>6</sup>

**A47L 15/48 15/42**

(52) UK CL (Edition O )

**A4F F29A2F**

(56) Documents Cited

**EP 0669097 A2 EP 0607628 A1 US 5273061 A**

**US 5056543 A**

(58) Field of Search

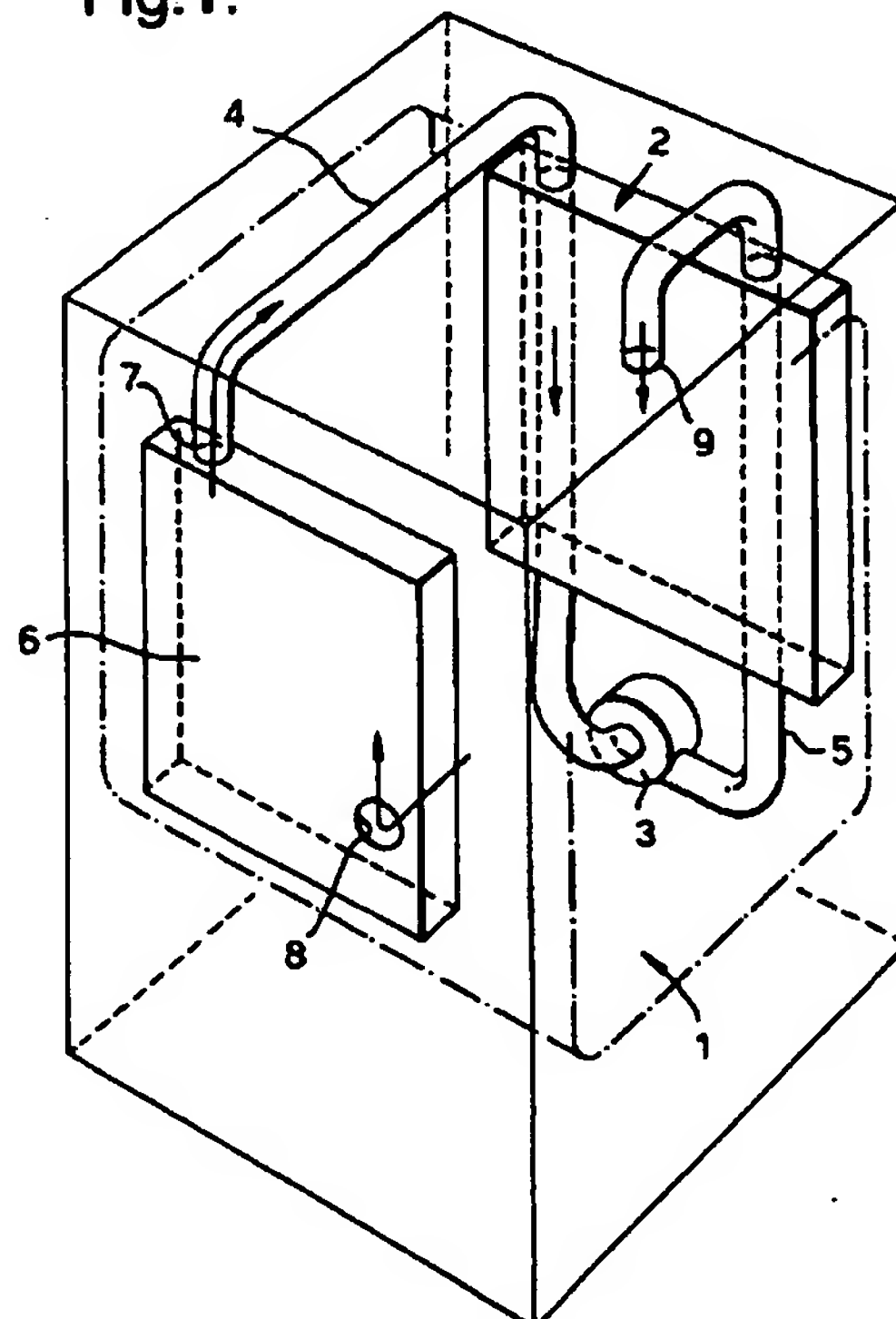
**UK CL (Edition O ) A4F F29A2F**

**INT CL<sup>6</sup> A47L 15/00 15/02 15/42 15/48**

(54) Dishwasher with water and heat recovery

(57) The dishwasher comprises a tub (1) and a tank (20 which temporarily stores the water from the hot rinse for reuse in subsequent washing) and a drying system with a condenser (6) by way of which drying air is circulated. The hot moist air from the drying stage is passed through the condenser (6) and into heat exchange relationship with the hot recovered water in the tank (2).

Fig.1.



GB 2 311 932 A

Fig.1.

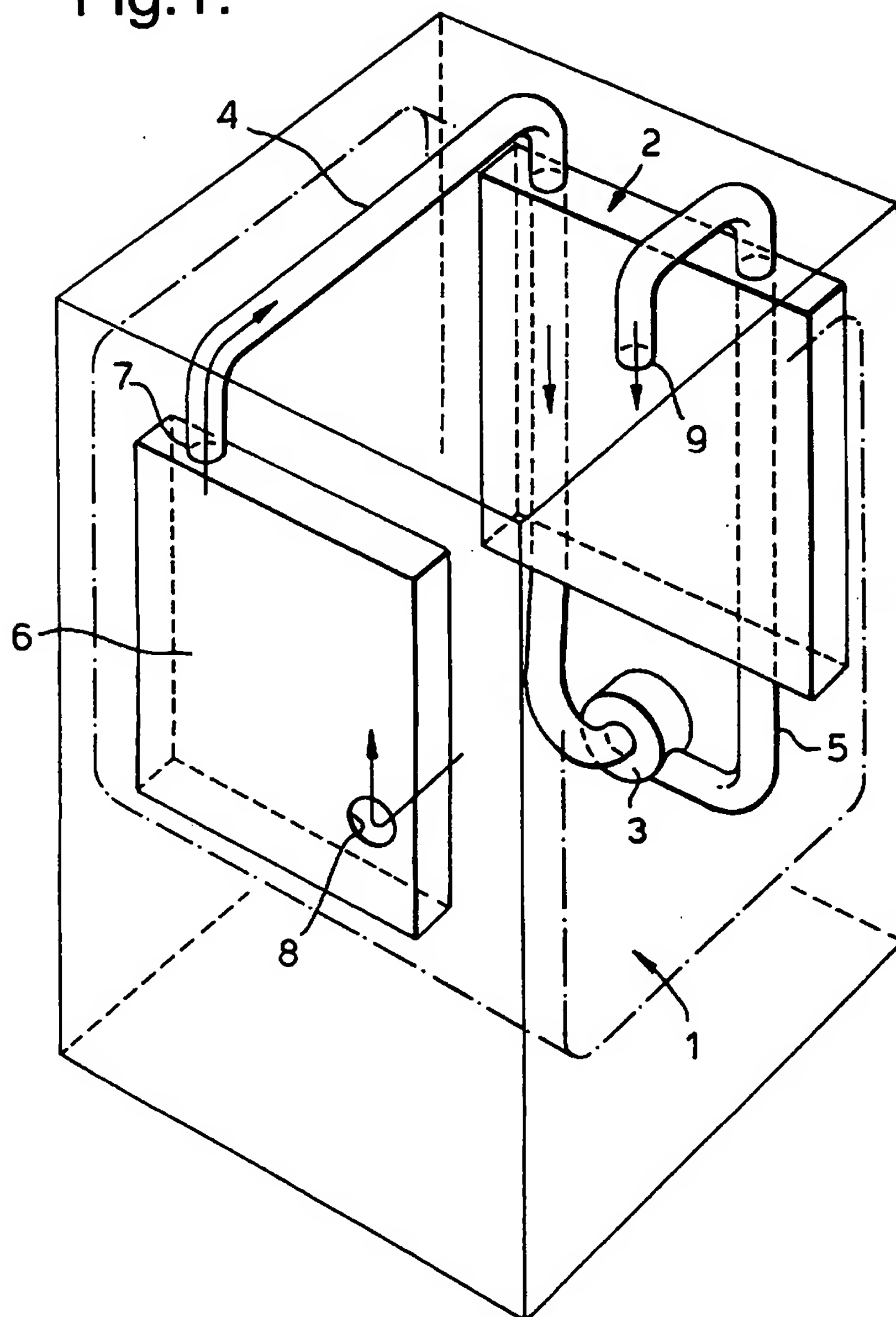
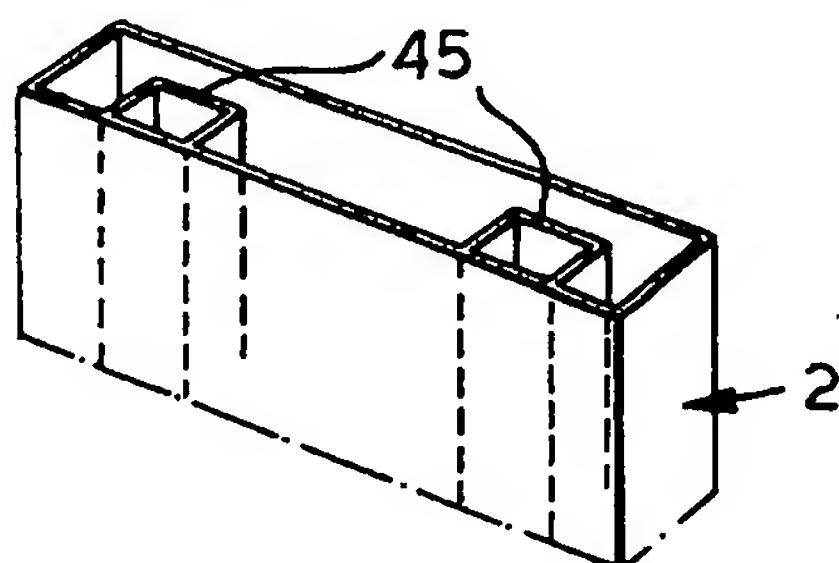


Fig.2.



**DISHWASHING MACHINE WITH TANK FOR WATER RECOVERY  
AND IMPROVED CONDENSATION-TYPE DRYING SYSTEM**

5       The present invention relates to a dishwashing machine provided with a system for drying the crockery of the condensation type, and a multi-functional water tank capable of permitting the recovery of water and heat for the purposes of general energy saving.

10       A dishwashing machine is known for example from EP-A-0669097, which is provided with a tank for storing the hot water from the last rinse phase for re-using it as washing water during a subsequent operating cycle.

15       Systems for clothes washing machines are also known, as described for example in EP-A-0287990, in which it is possible to recover not only water but also the heat from previously heated water. In particular the heat of hot water which is passed to the discharge can be transferred by means of a heat exchanger to the fresh water which is introduced into a washing machine for a subsequent operating cycle.

20       The known constructions advantageously permit an overall energy saving but they do not set the aim of improving drying of the crockery which is being dealt with in the situation where the machine is provided with a drying system of the condensation type. Dishwashing machines with  
25       condensation-type drying systems are well known. As described for example in US-A-5273061 a condenser disposed in the washing tub of a dishwashing machine has passing therethrough ambient cooling air which is circulated by a fan; the moist hot air present in the tub is condensed on the  
30       outside walls of the condenser, producing effective drying of the crockery.

35       Constructions are also known, for example from US-A-5056543, in which the hot moist air in the tub is directly circulated through the condenser (where it is cooled and moisture is removed therefrom), which condenser can be associated with auxiliary cooling systems.

      In any case the known condensation-type drying systems involve the problem that the moist air contained in the washing tub can be excessively cooled in contact with the

condenser, thus correspondingly cooling the crockery to be dried. For that reason evaporation of the water from the crockery is accordingly reduced, whereby it is necessary to have recourse to forced heating of the crockery itself, which  
5 is normally effected by suitably actuating the heating elements of the machine 'in the air', that is to say when they are not immersed in water. As is known, that involves undesirable problems in regard to possible overheating of the components and subjects to additional stresses the  
10 electromechanical and/or electronic interfaces associated with the heating elements.

The main aim of the present invention is that of providing a dishwashing machine with a tank for the recovery of water and a condensation-type drying system, which is  
15 capable of providing an effective overall energy saving, while at the same time providing for effective drying of the crockery.

In particular the aim of the invention is to provide a dishwashing machine of the specified type, which is  
20 of a simple structure and reliable in operation.

According to the present invention there is provided a dishwashing machine capable of performing operating cycles comprising at least one washing phase and/or at least one rinse phase with hot water for crockery  
25 contained in a tub, the dishwashing machine also comprising at least one recovery tank for storing at least part of the water of at least one said phase for re-using it during a subsequent operating phase, and further comprising a system for drying the crockery which is provided with a condenser in  
30 association with which drying air is circulated through a circuit, after said at least one such phase, at least a portion of said air circuit of the condensation system being in heat exchange relationship with the recovery tank.

The features and advantages of the invention will  
35 be clearly apparent from the following description given solely by way of non-limiting example, with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view showing only the main components of a preferred embodiment of the dishwashing machine; and

Figure 2 diagrammatically shows a detail in section of the dishwashing machine in Figure 1.

Referring to Figure 1 the dishwashing machine mainly comprises a washing tub 1 capable of containing crockery to be washed and/or rinsed by means of suitable spray means which are known per se and which are not shown for the sake of simplicity. In particular the washing tub 1 can be supplied with mains water in order, under the control of a programmer, to perform operating cycles mainly comprising at least one washing phase and/or at least one rinsing phase with water heated by an electrical resistance, or the like.

The dishwashing machine also comprises at least one tank 2 which, in per se known manner (not shown), for example as described in above-mentioned EP-A-0660097, is predisposed and connected to the hydraulic circuit of the machine in such a way as temporarily to accumulate at least part of the heated water used during a final rinse phase to re-utilise it in a subsequent operating phase, for example in a washing phase of a subsequent operating cycle, by passing it again into the washing tub 1. Alternatively the tank 2 can be designed as described in a co-pending patent application in the name of the present applicants.

The dishwashing machine is also provided with a system for drying the crockery, of the condensation type. The drying system comprises for example a fan 3 associated with at least one intake conduit 4 and at least one outlet conduit 5, by means of which conduits the hot moist air in the tub 1 at the end of a final rinse phase with heated water can be circulated in association with a condenser. The circuit for circulation of the drying air can be designed in various ways. For example an outlet opening 7 of the condenser 6 is connected to one end of the conduit 4 while an intake opening 8 of the condenser and a free end 9 of the conduit 5 communicate with the interior of the washing tub 1.

Therefore, when at the end of a final hot rinse phase the fan 3 is actuated to dry the crockery, the hot moist air contained in the tub is caused to flow in a circuit comprising the intake 8 of the condenser 6, the condenser  
5 itself, the outlet opening 7, the conduit 4, the fan 3 and the conduit 5, by way of the opening 9 of which the air returns into the tub 1.

In passing in association with the condenser 6 (which preferably is disposed on the outside of the tub 1 and  
10 can be associated with suitable cooling means) the air contained in the tub is cooled and moisture is removed therefrom, the condensate collecting on the walls of the condenser and possibly being passed to the bottom of the washing tub in per se known manner. Consequently the water  
15 deposited on the crockery tends to evaporate in such a way as to effect drying of the crockery. The quality of such drying action will be substantially proportional to the heat difference between the crockery and the surrounding area, in particular the condenser 6.

20 As already stated, in that phase at least part of the heated water used for the hot rinse is accumulated in the recovery tank 2 in per se known manner.

In accordance with the invention at least part of the air flow circuit 3-9 of the condensation system is in  
25 heat exchange relationship with the recovery tank 2.

For that purpose for example at least a portion of the intake conduit 4 and/or the outlet conduit 5 is in the form of a passage means 45 (Figure 2) which can be of various shapes, according to the requirements involved.

30 The passage means 45 can be simply in contact with the walls of the tank 2 but it preferably extends in the interior of the tank itself in such a way as to provide for effective heat exchange with the hot water contained therein.

Good operational efficiency and satisfactory  
35 structural simplicity can advantageously be achieved by making the tank 2 and the passage means 45 in one piece, for example of suitable plastics material.

In any case the heat exchange between the hot water contained in the tank 2 during the drying phase and the water



circulating in the drying system 3-9, as well as in the tub 1, advantageously prevent excessive cooling of the crockery which therefore (as has also been experimentally verified) is dried in the optimum manner without the need for undesirably actuating the heating members of the machine.

It will be appreciated that the dishwashing machine described may be the subject of numerous modifications which fall within the scope of the invention.

Similar advantages are also achieved in the situation where the condensation-type drying system is of a different type, for example of the type in which, as described in above-mentioned US-A-5273061, the air circulation circuit is separate from the interior of the tub 1.

## CLAIMS

1. A dishwashing machine capable of performing operating cycles comprising at least one washing phase and/or  
5 at least one rinse phase with hot water for crockery contained in a tub, the dishwashing machine also comprising at least one recovery tank for storing at least part of the water of at least one said phase for re-using it during a subsequent operating phase, and further comprising a system  
10 for drying the crockery which is provided with a condenser in association with which drying air is circulated through a circuit, after said at least one such phase, at least a portion of said air circuit of the condensation system being in heat exchange relationship with the recovery tank.  
15
2. A dishwashing machine according to claim 1 wherein at least said portion of the air circuit is in the form of a passage means extending in the interior of the recovery tank.
- 20 3. A dishwashing machine according to claim 2 wherein said passage means is in one piece with said recovery tank.
4. A dishwashing machine constructed and arranged to operate substantially as hereinbefore described with  
25 reference to and as illustrated in the accompanying drawings.



**Amendments to the claims have been filed as follows**

1. A dishwashing machine capable of performing  
operating cycles comprising at least one washing phase and/or  
5 at least one rinse phase with hot water for crockery  
contained in a tub, the dishwashing machine also comprising  
at least one recovery tank for storing at least part of the  
water of at least one said phase for re-using it during a  
subsequent operating phase, and further comprising a system  
10 for drying the crockery which is provided with a condenser in  
association with which drying air is circulated through a  
circuit, after said at least one such phase, at least a  
portion of said air circuit of the condensation system being  
in heat exchange relationship with the recovery tank so as to  
15 prevent excess cooling of the crockery.
2. A dishwashing machine according to claim 1 wherein  
at least said portion of the air circuit is in the form of a  
passage means extending in the interior of the recovery tank.  
20
3. A dishwashing machine according to claim 2 wherein  
said passage means is in one piece with said recovery tank.
4. A dishwashing machine constructed and arranged to  
25 operate substantially as hereinbefore described with  
reference to and as illustrated in the accompanying drawings.



Application No: GB 9707056.9  
Claims searched: 1-4

Examiner: John Fulcher  
Date of search: 19 May 1997

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A4F (F29A2F)

Int Cl (Ed.6): A47L 15/00, 15/02, 15/42, 15/48

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0669097 A2 (ZANUSSI)	1
X	EP 0607628 A1 (CANDY) -see figs and column 2 lines 23-28	
A	US 5273061 (MILOCCO)	
A	US 5056543 (DYGVE)	

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.